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Life Sciences

Using Spider-Web Patterns To Determine Toxicity

Webs are visibly altered when spun by spiders exposed to chemicals.

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A method of determining the toxicities of chemicals involves recording and analysis of spider-web patterns. The method is based on the observation that spiders exposed to various chemicals spin webs that differ, in various ways, from their normal webs (see figure). Spider-web toxicity testing has potential as an alternative to toxicity testing on higher animals, which is expensive, time-consuming and becoming increasingly restricted by law.

The changes in webs reflect the degree of toxicity of a substance. The more toxic the chemical, the more deformed a web looks in comparison with a normal web. Inasmuch as the shape of a spider web resembles that of a crystal lattice in some respects, techniques of statistical crystallography are applied to obtain several quantitative measures of toxicity as manifested in the differences between photographs of webs spun under toxic and normal conditions.

The images of the cells are digitized and processed by an image-data-analysis program that computes various measures of the cellular structures of the webs, including numbers of cells and average areas, perimeters, and radii of cells. It appears that one of the most telling measures of toxicity is a decrease, in comparison with a normal web, of the numbers of completed sides in the cells: the greater the toxicity, the more sides the spider fails to complete.

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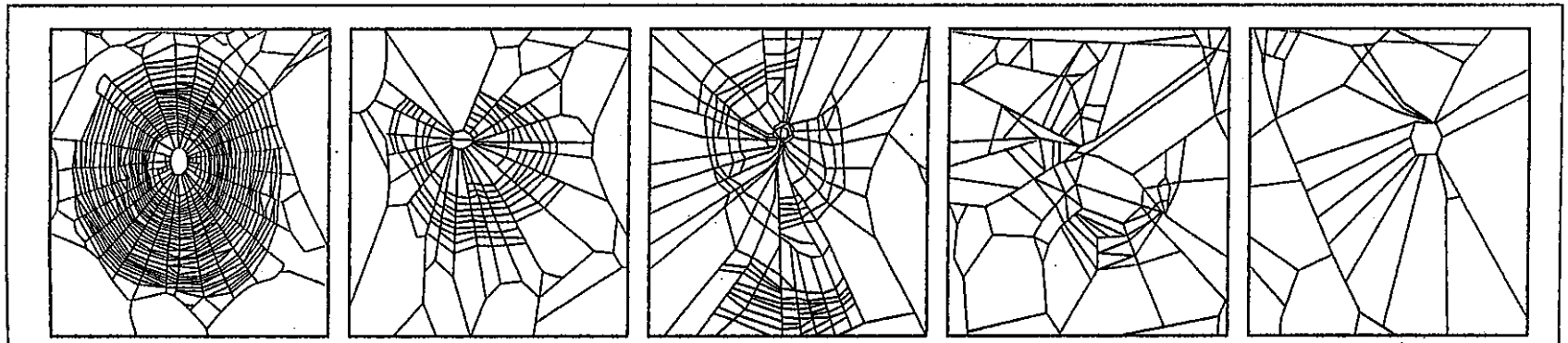

The Web Spun by an Araneus diadematus (House Spider) is altered when the spider is exposed to chemicals. The alterations can be quantified and used as measures of toxicity.